



MOTOROLA

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MC1490

RF/IF/Audio Amplifier

The MC1490 is an integrated circuit featuring wide-range AGC for use in RF/IF amplifiers and audio amplifiers over the temperature range, -40° to $+85^{\circ}\text{C}$.

- High Power Gain: 50 dB Typ at 10 MHz
45 dB Typ at 60 MHz
35 dB Typ at 100 MHz
- Wide Range AGC: 60 dB Min, DC to 60 MHz
- 6.0 V to 15 V Operation, Single Polarity Supply
- See MC1350D for Surface Mount

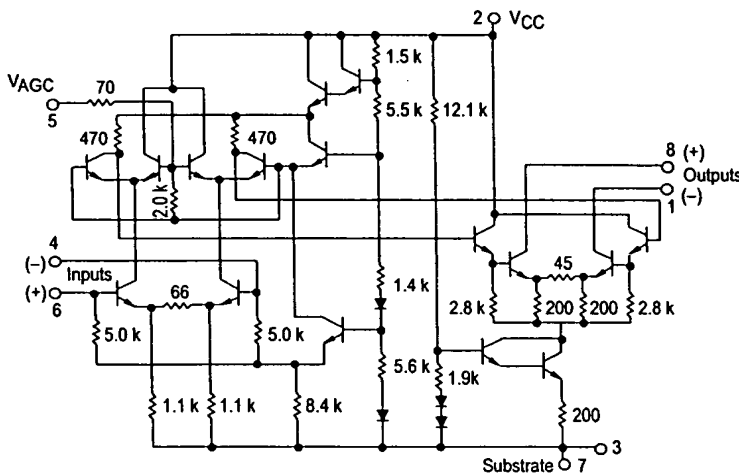
MAXIMUM RATINGS ($T_A = +25^{\circ}\text{C}$, unless otherwise noted.)

Rating	Symbol	Value	Unit
Power Supply Voltage	V_{CC}	+18	Vdc
AGC Supply	V_{AGC}	V_{CC}	Vdc
Input Differential Voltage	V_{ID}	5.0	Vdc
Operating Temperature Range	T_A	-40 to $+85$	$^{\circ}\text{C}$
Storage Temperature Range	T_{stg}	-65 to $+150$	$^{\circ}\text{C}$
Junction Temperature	T_J	+150	$^{\circ}\text{C}$

ORDERING INFORMATION

Device	Operating Temperature Range	Package
MC1490P	$T_A = -40^{\circ}$ to $+85^{\circ}\text{C}$	Plastic

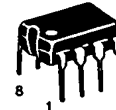
Representative Schematic Diagram



Pins 3 and 7 should both be connected to circuit ground.

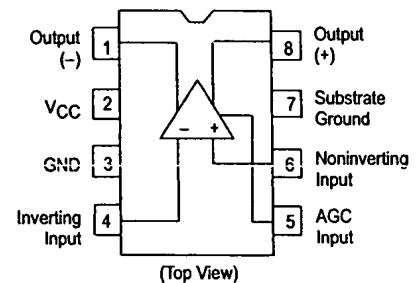
WIDEBAND AMPLIFIER WITH AGC

SEMICONDUCTOR TECHNICAL DATA



P SUFFIX
PLASTIC PACKAGE
CASE 626

PIN CONNECTIONS



SCATTERING PARAMETERS

($V_{CC} = +12\text{ Vdc}$, $T_A = +25^{\circ}\text{C}$, $Z_0 = 50\ \Omega$)

Parameter	Symbol	f = MHz Typ		Unit
		30	60	
Input Reflection Coefficient	$ S_{11} $ 011	0.95 -7.3	0.93 -16	- deg
Output Reflection Coefficient	$ S_{22} $ 022	0.99 -3.0	0.98 -5.5	- deg
Forward Transmission Coefficient	$ S_{21} $ 021	16.8 128	14.7 64.3	- deg
Reverse Transmission Coefficient	S_{12} 012	0.00048 84.9	0.00092 79.2	- deg

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ELECTRICAL CHARACTERISTICS ($V_{CC} = 12 \text{ Vdc}$, $f = 60 \text{ MHz}$, $BW = 1.0 \text{ MHz}$, $T_A = 25^\circ\text{C}$)

Characteristic	Figure	Symbol	Min	Typ	Max	Unit
Power Supply Current Drain	—	I_{CC}	—	—	17	mA
AGC Range (AGC) 5.0 V Min to 7.0 V Max	19	M_{AGC}	-60	—	—	dB
Output Stage Current (Sum of Pins 1 and 8)	—	I_O	4.0	—	7.5	mA
Single-Ended Power Gain $R_S = R_L = 50 \Omega$	19	G_p	40	—	—	dB
Noise Figure $R_S = 50 \text{ Ohms}$	19	NF	—	6.0	—	dB
Power Dissipation	—	P_D	—	168	204	mW

Figure 1. Unneutralized Power Gain versus Frequency (Tuned Amplifier, See Figure 19)

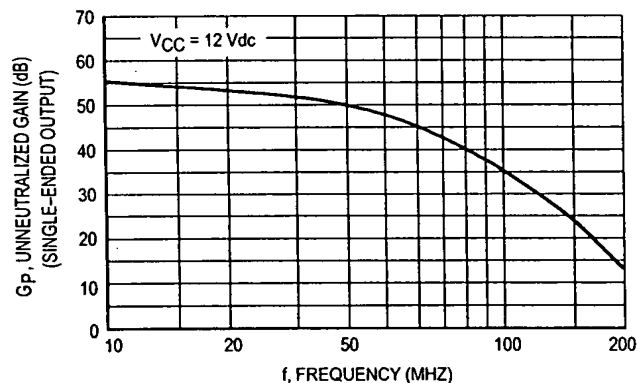


Figure 2. Voltage Gain versus Frequency (Video Amplifier, See Figure 20)

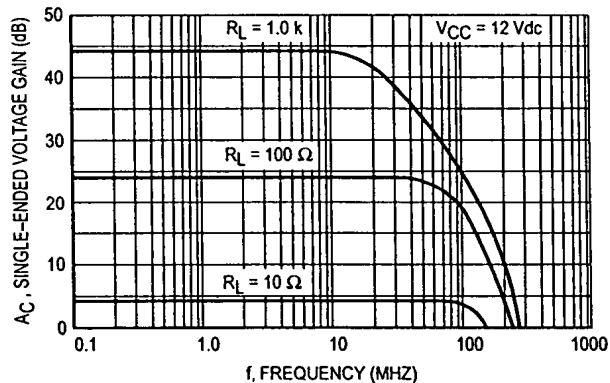


Figure 3. Dynamic Range: Output Voltage versus Input Voltage (Video Amplifier, See Figure 20)

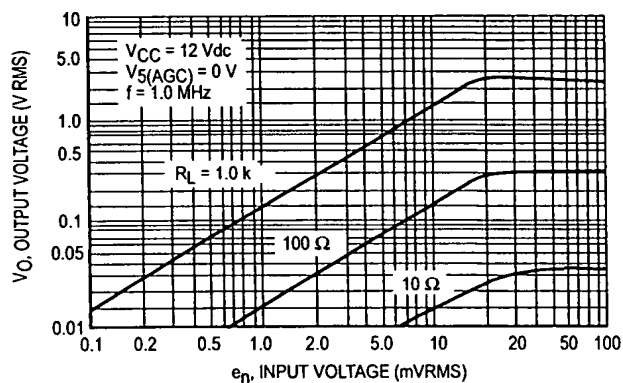
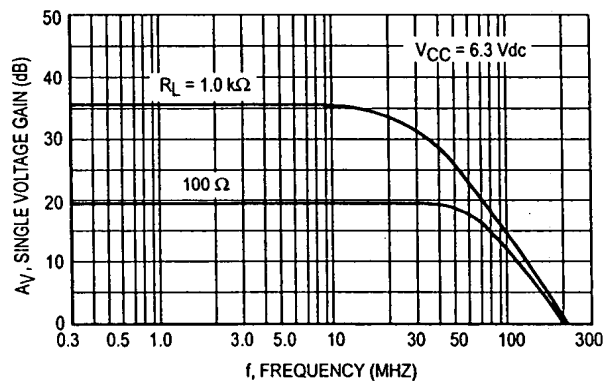


Figure 4. Voltage Gain versus Frequency (Video Amplifier, See Figure 20)



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Figure 5. Voltage Gain and Supply Current versus Supply Voltage (Video Amplifier, See Figure 20)

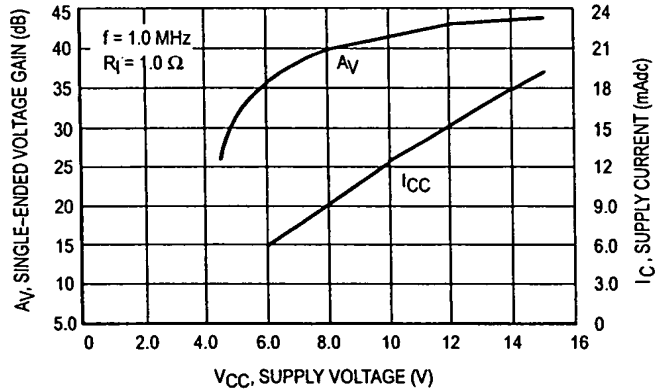


Figure 6. Typical Gain Reduction versus AGC Voltage

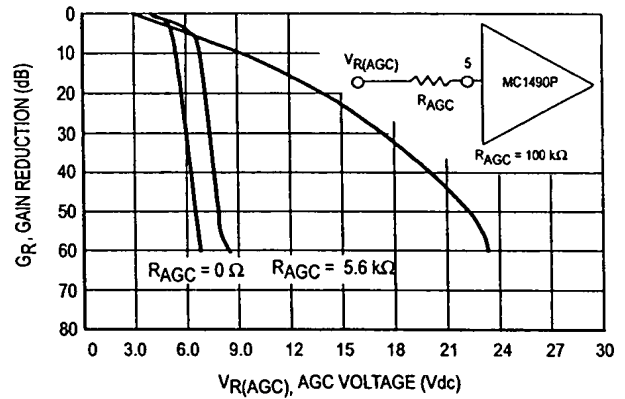


Figure 7. Typical Gain Reduction versus AGC Current

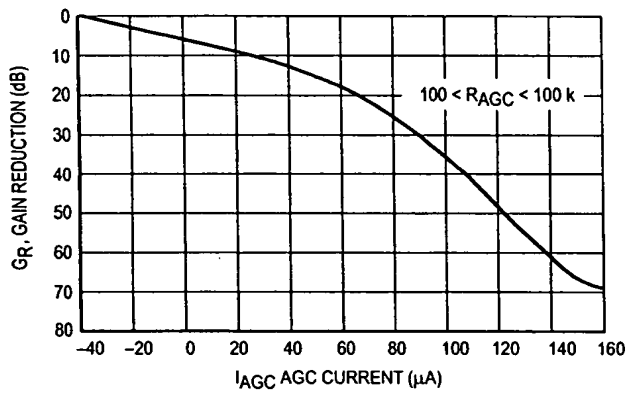


Figure 8. Fixed Tuned Power Gain Reduction versus Temperature (See Test Circuit, Figure 19)

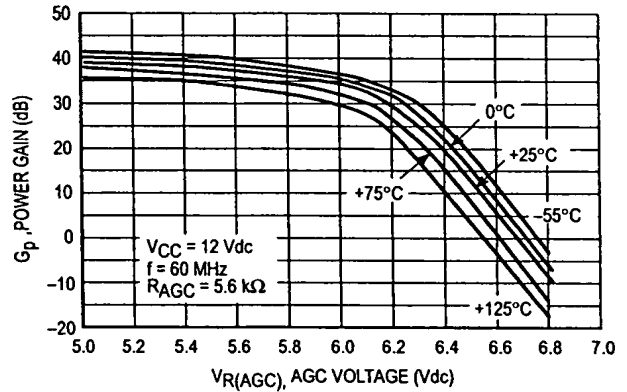


Figure 9. Power Gain versus Supply Voltage (See Test Circuit, Figure 19)

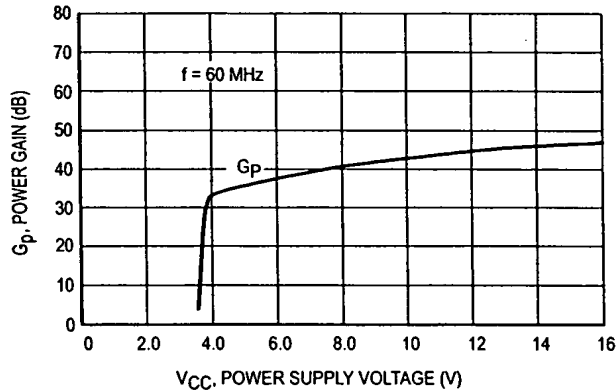
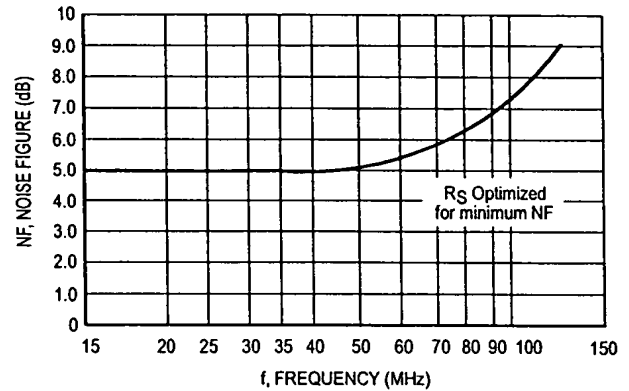


Figure 10. Noise Figure versus Frequency



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Figure 11. Noise Figure versus Source Resistance

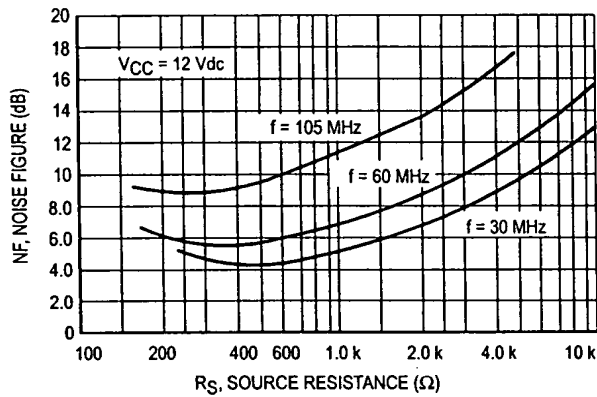


Figure 12. Noise Figure versus AGC Gain Reduction

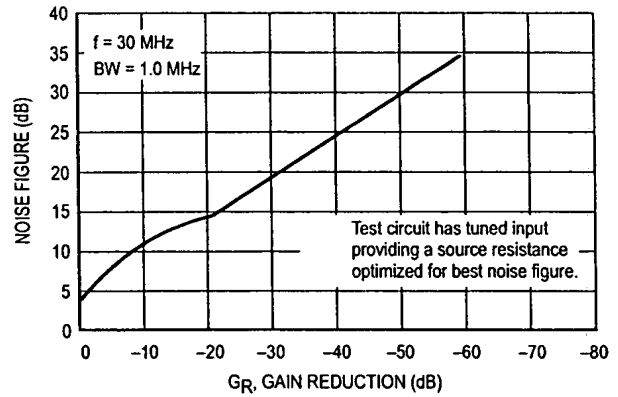


Figure 13. Harmonic Distortion versus AGC Gain Reduction for AM Carrier (For Test Circuit, See Figure 14)

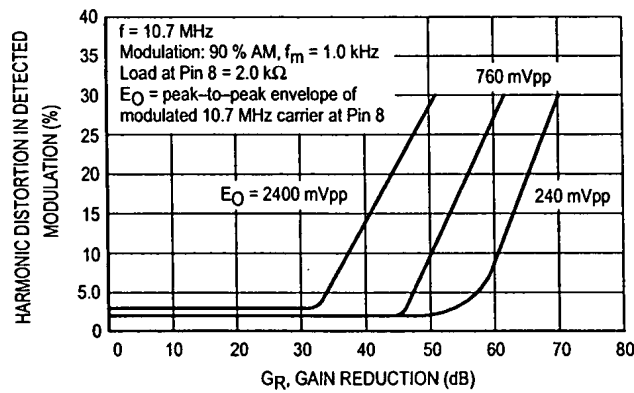
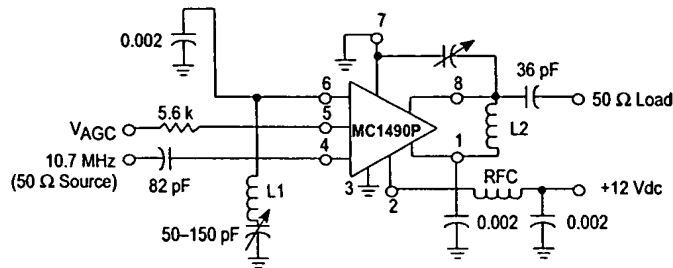


Figure 14. 10.7 MHz Amplifier Gain $\approx 55 \text{ dB}$, $\text{BW} \approx 100 \text{ kHz}$



L1 = 24 turns, #22 AWG wire on a T12-44 micro metal Toroid core ($\sim 124 \text{ pF}$)

L2 = 20 turns, #22 AWG wire on a T12-44 micro metal Toroid core ($\sim 100 \text{ pF}$)

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Figure 15. S_{11} and S_{22} , Input and Output Reflection Coefficient

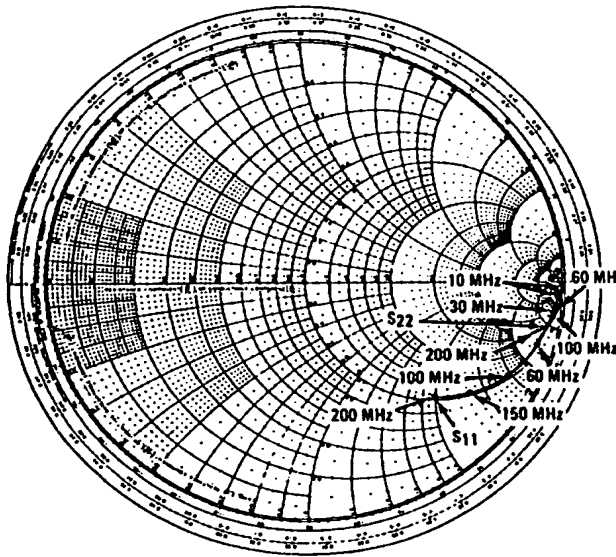


Figure 16. S_{11} and S_{22} , Input and Output Reflection Coefficient

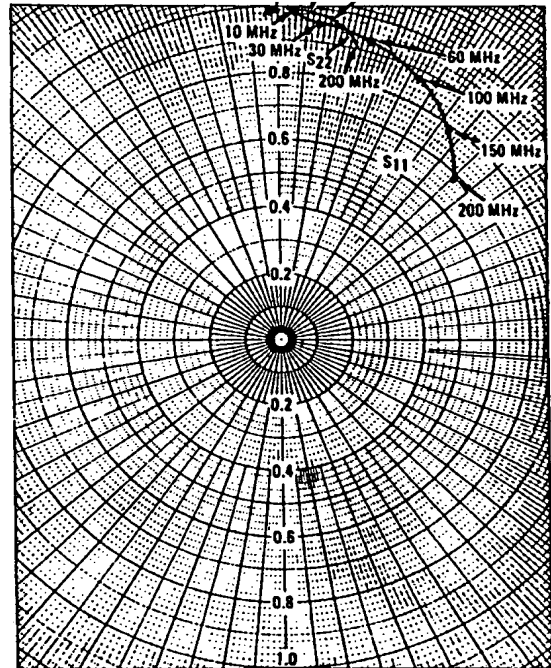


Figure 17. S_{21} , Forward Transmission Coefficient (Gain)

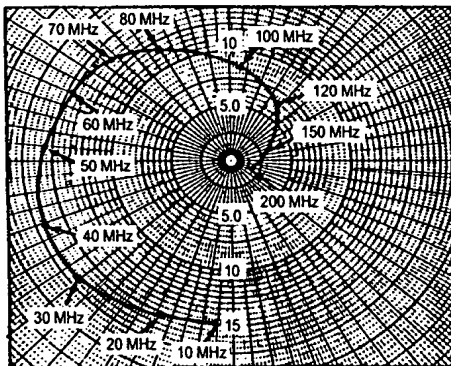
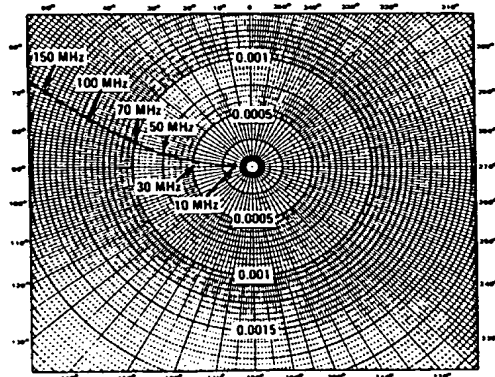
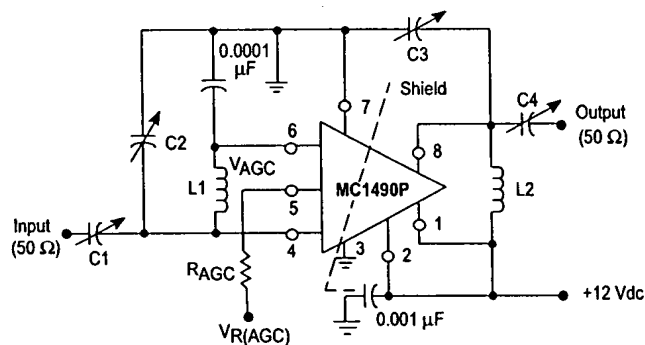


Figure 18. S_{12} , Reverse Transmission Coefficient (Feedback)



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Figure 19. 60 MHz Power Gain Test Circuit



L1 = 7 turns, #20 AWG wire, 5/16" Dia., 5/8" long
 L2 = 6 turns, #14 AWG wire, 9/16" Dia., 3/4" long
 C1, C2, C3 = (1-30) pF
 C4 = (1-10) pF

Figure 20. Video Amplifier

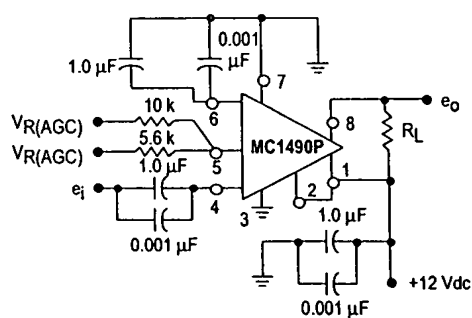
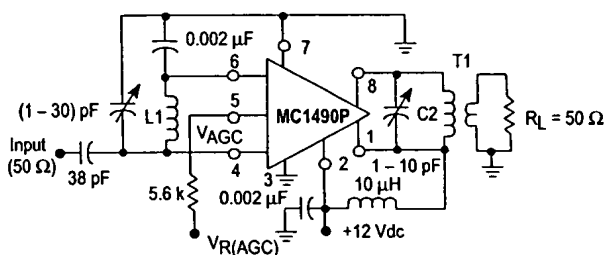
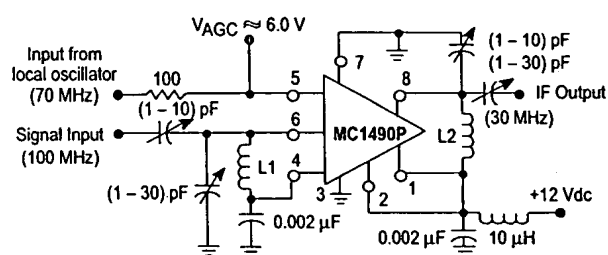


Figure 21. 30 MHz Amplifier
 (Power Gain = 50 dB, BW ≈ 1.0 MHz)



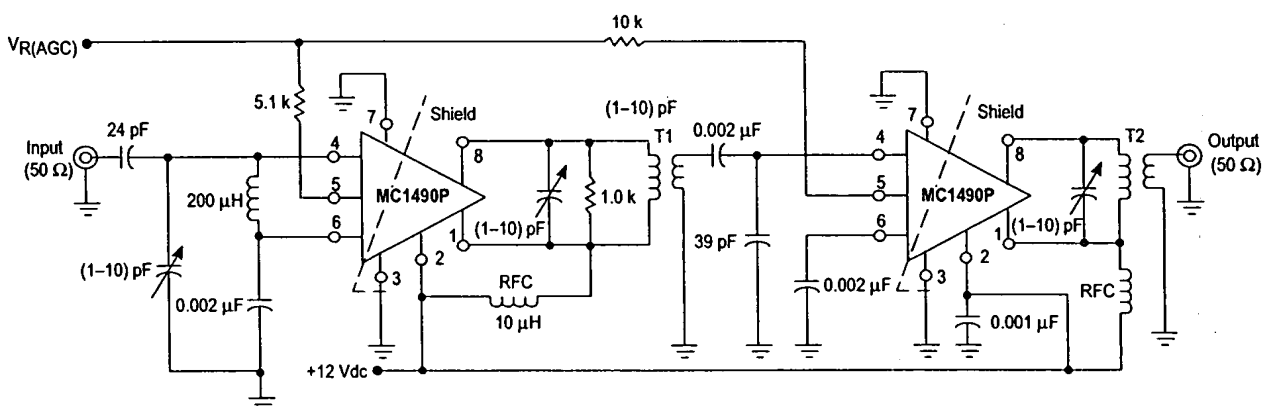
L1 = 12 turns, #22 AWG wire on a Toroid core,
 (T37-6 micro metal or equiv).
 T1: Primary = 17 turns, #20 AWG wire on a Toroid core, (T44-6).
 Secondary = 2 turns, #20 AWG wire.

Figure 22. 100 MHz Mixer



L1 = 5 turns, #16 AWG wire, 1/4", ID Dia., 5/8" long
 L2 = 16 turns, #20 AWG wire on a Toroid core, (T44-6).

Figure 23. Two-Stage 60 MHz IF Amplifier (Power Gain ≈ 80 dB, BW ≈ 1.5 MHz)



T1: Primary Winding = 15 turns, #22 AWG wire, 1/4" ID Air Core
 Secondary Winding = 4 turns, #22 AWG wire,
 Coefficient of Coupling ≈ 1.0

T2: Primary Winding = 10 turns, #22 AWG wire, 1/4" ID Air Core
 Secondary Winding = 2 turns, #22 AWG wire,
 Coefficient of Coupling ≈ 1.0

DESCRIPTION OF SPEECH COMPRESSOR

The emitter-follower Q2 drives the AGC Pin 5 of the MC1490P and reduces the gain. R3 controls the slope of signal compression.

Frequency	Distortion		Distortion	
	10 mV e_i	100 mV e_i	10 mV e_i	100 mV e_i
100 Hz	3.5%	12%	15%	27%
300 Hz	2%	10%	6%	20%
1.0 kHz	1.5%	8%	3%	9%
10 kHz	1.5%	8%	1%	3%
100 kHz	1.5%	8%	1%	3%
	Notes 1 and 2		Notes 3 and 4	

Notes: (1) Decay = 300 ms
Attack = 20 ms
(2) $C_X = 7.5 \mu F$
 $R_Y = 0$ (Short)

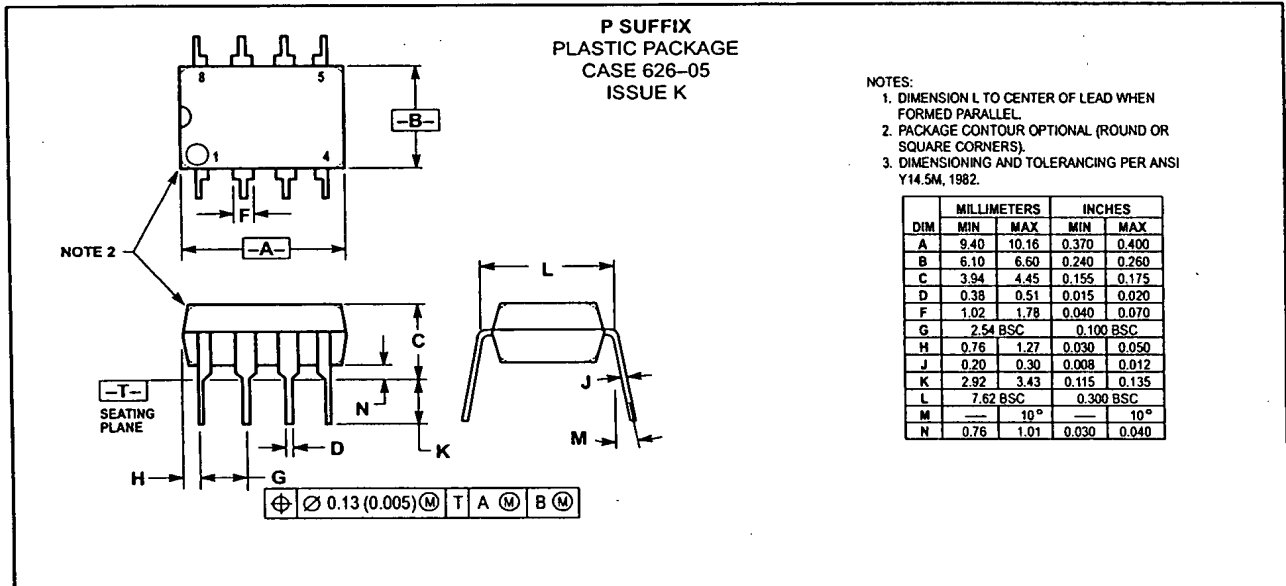
(3) Decay = 20 ms
Attack = 3.0 ms

(4) $C_X = 0.68 \mu\text{F}$
 $R_X = 1.5 \text{ k}\Omega$

The circuit diagram shows a precision rectifier using an MC1490P op-amp and two 2N3904 transistors. The op-amp is configured with its non-inverting input (pin 5) to ground and its inverting input (pin 2) to the input signal through a 15 μF capacitor. The op-amp's output (pin 8) is connected to the base of a 2N3904 transistor (Q1) through a 2.2 kΩ resistor. The emitter of Q1 is connected to ground through a 33 kΩ resistor. The collector of Q1 is connected to the positive output terminal through a 2.2 kΩ resistor. The negative output terminal is connected to the emitter of another 2N3904 transistor (Q2) through a 4.7 kΩ resistor. The base of Q2 is connected to the op-amp's output (pin 8) through a 2.2 kΩ resistor. The collector of Q2 is connected to the positive output terminal through a 2.2 kΩ resistor. The op-amp's supply pins (1 and 4) are connected to a +12 V supply through a 25 μF capacitor and a 0.001 μF capacitor. The op-amp's ground pins (3 and 7) are connected to ground through a 1.0 kΩ resistor and a 1.0 kΩ resistor. The op-amp's output (pin 8) is connected to ground through a 10 μF capacitor. The op-amp's output (pin 8) is also connected to the positive output terminal through a 10 μF capacitor. The op-amp's output (pin 8) is also connected to the negative output terminal through a 10 μF capacitor. The op-amp's output (pin 8) is also connected to the positive output terminal through a 10 μF capacitor.

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OUTLINE DIMENSIONS



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